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Abstract

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IS THE DRIVER DRUNK?

OCULOMOTOR SOBRIETY TESTING

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INTRODUCTION

Alcohol gaze nystagmus (AGN) is a well documented phenomenon that has been described by several authors.(1,2,3,4,5) It is a horizontal, jerky nystagmus that is elicited on horizontal gaze. It appears when the blood alcohol concentration (BAC) reaches a certain threshold level, and disappears when the BAC falls below the threshold. The angle of onset and the intensity are both correlated with the BAC. The higher the BAC, the smaller the horizontal deviation the nystagmus will occur at, and the more intense the nystagmus becomes as the horizontal deviation increases. AGN is distinguishable from end point nystagmus due to its onset prior to full lateral excursion, and its more apparent intensity at the end point of gaze.

Testing of this and other ocular phenomena (smooth pursuit movements, pupillary evaluation) in the investigation of suspected intoxicated drivers is on the rise among law enforcement agencies throughout the United States. It would be valuable for the optometrist to have some knowledge about the origin, validity, and use of the specific test procedures, in that the OD may be sought out for information by patients and/or local law enforcement personnel.

BACKROUND

It is well known that the drunk driver is the source of great misery on our nation's roadways. The latest statistics show that from 1975-1985, alcohol-related accidents injured 650,000 people per year, and caused a total of 250,000

fatalities.(6) Historically, the roadside investigation of the suspected DWI (Driving While Intoxicated [or Impaired]) has been a very subjective, non-standard procedure. The law enforcement officer's observations and choice of behavioral tests used to determine impairment have been highly variable around the country.(7) In the last 10-15 years, the subjectivity and reliability of these procedures came under question, and the move to develop standardized, reliable procedures for the roadside investigation of the suspected impaired driver was begun. The National Highway Traffic Safety Administration (NHTSA), a branch of the U.S. Department of Transportation, has been working with research groups and law enforcement agencies around the country in the effort to develop and implement improved, standardized roadside sobriety tests.

THE LAWS

Before delving into a discussion of the use of gaze nystagmus, it would be of value to first provide some backround about the laws regarding the impaired driver, and what it is the police officer must ascertain at the roadside.

The "legal limit" of BAC (blood alcohol concentration) varies from state to state, and it is currently a rapidly changing entity as many states are lowering the limit in the crackdown on drunk driving. The great majority of states use 0.10% BAC as the limit, with only a few states as low as 0.08% or as high as 0.15%. There are two types of laws that states use to define the "legal limit" and states may have

either, or both of the laws on the books. The less stringent law is the Presumptive BAC: a person with a specified BAC (i.e., 0.10%) is presumed to be impaired. Obviously some individuals are impaired with much less alcohol in their blood, while other individuals can show that they are not impaired even at higher levels. Having a Presumptive Law leaves the legal door open for the arrested driver to argue that he/she was admittedly intoxicated, but not impaired. The more stringent law, currently in effect in all but seven states, is called the Illegal Per Se Law, which flatly states that it is illegal to operate a vehicle at or above a specified BAC. Additionally, every state has an Applied Consent Law, which means that upon applying for a driver's license, the individual consents to a lawful request for a breath (or in some states also a blood and/or urine) test to determine BAC. The individual has the right to refuse, but in doing so automatically forfeits their license.

It is in the context of these laws that an officer on the street or highway must decide whether or not to arrest the suspected impaired driver. The officer may have to testify in court as to why the arrest was made, and for this reason many police officers are reluctant to arrest a driver unless there is a high degree of certainty that a chemical test will show a BAC of 0.10% or higher.(7) To answer this need, the NHTSA contracted the Southern California Research Institute (SCRI) in the mid 1970's to do the necessary laboratory and field research to establish a battery of tests

that an officer could administer during a roadside investigation of a suspected drunk driver.

RESEARCH

In 1977 the NHTSA published its first report on the work done by SCRI.(7) Based on reviews of the sobriety test literature and observations of police officers in numerous locales around the country, certain physiologic and behavioral tests were singled out for laboratory evaluation of their potential value as a roadside screening test of driver impairment. The conditions of roadside testing often impose difficult constraints. The decision to arrest or not arrest must be made in a very short time, only a few minutes at the most. Accuracy in decision making is vital. Not arresting persons who are impaired is obviously undesirable, but false positive arrests, arresting people who are not impaired also has negative repercussions. The conditions at the roadside are usually less than optimum. It is likely to be nighttime, weather may be inclement, traffic may be heavy, the road may be narrow, and so on. The tests and observations done by the officer must be easy, safe, and quick to administer, as well as give accurate and reliable information. The 1977 NHTSA report narrowed down numerous possible test combinations to a 3-test battery: alcohol gaze nystagmus, a walk and turn test, and a one leg stand. Of these three, the gaze nystagmus was the single best indicator of whether an individual's BAC was above or below 0.10%. In this laboratory study, when comparing these three tests as if

each was the only test used to determine if BAC was above or below 0.10%, the gaze nystagmus elicited 81.8% correct assessments, the one leg stand elicited 75.5%, and the walk-and-turn 75.1%. For the three tests together, 83.4% correct classifications were made. This result was in agreement with a Finnish study that was cited (8), particularly with regard to the importance of the gaze nystagmus test. Both the NHTSA study and the work done in Finland identified the nystagmus test to be the most valuable index of intoxication. Its importance is further heightened because it is an involuntary, uncontrolled response, one that could not be practiced as the other two tests might.

A follow-up study was again done by SCRI and published by the NHTSA in 1981.(9) This study further refined and standardized the administration of the 3-test psychophysical battery, and included some limited field testing of the procedures. A significant finding was the -0.76 correlation of BAC to angle of onset of the gaze nystagmus. This agreed with the cited -0.788 correlation determined by Lehti (10), confirming quantitatively that the angle of onset decreased as BAC increased. It was also found that a BAC of 0.10% elicited nystagmus at 40 deg. Furthermore, it was shown that with proper training in administering the 3-test battery, officers were able to reliably estimate the BAC of laboratory subjects to within 0.03%. Once again, the gaze nystagmus was held to be the most sensitive test in the battery.

A NHTSA study in 1983 (11) expanded the field testing of

the 3-test battery, and the most recent NHTSA study, published in 1985 (12), discusses a test battery for use at sobriety checkpoints on the roadways. Both of these studies further highlight the use of alcohol gaze nystagmus as the premiere test in the evaluation of the suspected drunk driver.

TEST PROCEDURES

The investigation of the suspected impaired driver has distinct phases, as described in the NHTSA Improved Sobriety Testing Trainee's Instruction Manual.(13) First, the officer observes a vehicle in motion and makes a decision to stop the vehicle. Second, the officer interviews and observes the driver still seated in the vehicle, and must decide whether the driver should exit the vehicle for further testing. Third, if the driver has exited the vehicle, the officer performs the 3-test battery: gaze nystagmus, walk and turn, and one leg stand. Finally, the officer must decide whether or not to arrest the driver. As can be seen, the use of the nystagmus test is only one component of a more involved process.

The actual nystagmus test involves three components: 1) smooth lateral pursuits, 2) the severity of nystagmus at the end point of gaze, and 3) does nystagmus begin before a 45 deg. lateral deviation. Smooth pursuits have been shown to deteriorate into saccadic fixations under the influence of alcohol.(14) No specific target is required, but the use of a penlight or finger tip is suggested. The target is to be

held at 12-15" for "ease of focus", though officers are trained to administer the test with the driver's spectacles removed. The officers are instructed to ask if the driver is wearing hard contact lenses, and not to do the test if affirmative for fear of dislodging a lens. The instructions to the driver are: "I am going to check your eyes...keep your head still and follow this (object is indicated) with your eyes only...keep focusing on this until I tell you to stop".(13)

The officer learns to determine the 45 deg. angle using a template, but no instrument is used in the field. The officer scores the ocular evaluation on a 6 point scale, 3 points for each eye. The right eye is viewed on rightward gaze for all three signs (smooth pursuit, nystagmus at end point, onset relative to 45 deg.), and the left eye is viewed on leftward gaze for all three. Any failed test for either eye counts for 1 point. A suspect who scores 4 or more points can be classified at or above 0.10 BAC with approximately 80% accuracy (+/- 3% depending on which NHTSA study is referred to). A cautionary note in the training manual warns that about 3% of the population will show early-onset nystagmus and impaired balance with no alcohol in their system. This is attributed to drugs other than alcohol (i.e. barbiturates, phencyclidine [PCP]), brain damage, illness, or of unknown etiology.

A somewhat different program has been developed by the Los Angeles (CA) Police Department (LAPD), and currently they

are conducting a joint study with the Johns-Hopkins University. The LAPD was rightfully concerned that many impaired drivers are under the influence of drugs other than alcohol. Whereas the NHTSA 3-test battery is directed solely at identifying the drunk driver, the LAPD developed a test battery to try to identify other intoxicants.(15,16) An officer that undergoes this training qualifies as a DRE (Drug Recognition Expert). The test battery includes a number of ocular observations, including nystagmus (possibly different from gaze nystagmus), specific angle of onset of gaze nystagmus if it occurs, eye movements, pupil dilatation, and pupillary reaction to light. The specifics of this battery and the literature documentation will not be dealt with here.

DISCUSSION

While the work by NHTSA is quite comprehensive and substantive, there are certain areas of the research and training guidelines that may be open to question. With regard to performing the gaze nystagmus test, the 1981 report (9) states that a number of variables are unimportant and can be ruled out. These variables include monocular vs. binocular viewing, fixation distance, stimulus brightness, and room brightness. No discussion was provided how it was ascertained that these variables are inconsequential. With regard to monocular vs. binocular viewing, the question may be raised about latent nystagmus, defined as occurring when one eye is occluded.(17) Furthermore, the test is performed with glasses removed, and no account is made for high

refractive errors or presbyopia. Fixation distance, stimulus brightness, and room (backround) brightness are described as being unimportant, but this seems questionable in the case of uncorrected myopia or hyperopia of significant amount, or presbyopia. These conditions may well have no effect on alcohol gaze nystagmus per se, but they will likely have an effect on the person's abililty to see the fixation target and properly take the test. This will also have an impact on the smooth pursuit evaluation. This brings up the topic of variables that were not addressed, one of which was smooth pursuits. Though Wilkinson et al.(14) showed that pursuit movements break down under the influence of alcohol, no attention is given to the wide range of tracking ability that exists in the general population. Neither the research nor the training manual make any mention of distinguishing poor pursuits due to alcohol from poor eye movement skills. A second variable that was not addressed is the condition of limitation of gaze. Though the incidence of this anomaly is difficult to determine and is likely to be low, mention of this seems warranted to provide some protocol for an officer if confronted by this situation.

In spite of these questions that are raised, it is important to remember that the gaze nystagmus test is just one part of a behavioral observation and test battery, and that decisions to arrest are not made by this test alone. These questions are only offered as possible ways of making the alcohol gaze nystagmus test more effective.

SUMMARY

A new test has recently been developed whereby law enforcement agents evaluate ocular phenomena in the investigation of suspected impaired drivers. Officers are trained to score smooth pursuit eye movements, intensity of jerky nystagmus at the full excursion of lateral gaze, and whether or not the angle of onset of the nystagmus is less than 45 deg. These observations are one component of a psychophysical test battery that provides approximately 80% accuracy in identifying blood alcohol concentration (BAC) as either less than or greater than 0.10%. A more sophisticated test battery which includes an estimate of the actual angle of onset of nystagmus, observation of nystagmus other than alocohol gaze type, and pupillary evaluation is currently being studied. The research and documentation of the test procedures are substantive, but certain questions were raised. The testing parameters of monocular vs. binocular viewing, vertical position of the eyes, target fixation distance, target brightness, and backround illumination were all reported to be unimportant. The conditions of latent nystagmus and high refractive error when spectacles are removed to perform the test were suggested as possible confounding conditions. Also, the absence of attention to the conditions of poor smooth tracking ability and limitation of gaze was addressed.

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